IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

COURSE RECOMMENDATION AND SKILL PREDICTION BASED ON CAREER CHOICE

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Abstract: Online courses play an significant role in the developing of new skills in students. As a result of open learning platforms and online courses, there is an increasing number of online courses, and certifications available on the internet from various universities. This project is a machine learning-driven course recommendation system that uses the concepts of decision trees in machine learning to provide an effective method for making decisions and generating all the possible outcomes. The K-NN algorithm also helps to store all the available data, classifies a new data point based on the similarity, and produces the desired results. This project suggests appropriate learning courses for students by viewing their study streams and interests. For students to achieve their ideal goals, choosing a learning pathway is essential. However, since there is an abundance of knowledge that is obviously related, it can be difficult for students to select a course that combines their interests and future demands. This proposed framework suggests courses that have previously been taken by similar students, facilitating students to choose a course of study based on their interests. The suggested method makes use of a number of data mining strategies to find correlations between courses. Evaluations based on analysis parts are a key component of the project's methodology. With the help of these methods, we are able to select a suitable course that is given as input, then provide courses that satisfy various requirements. The outcomes meet the requirements for discovering related courses and providing them via cross-platform apps to the students who will use them to enhance their education.

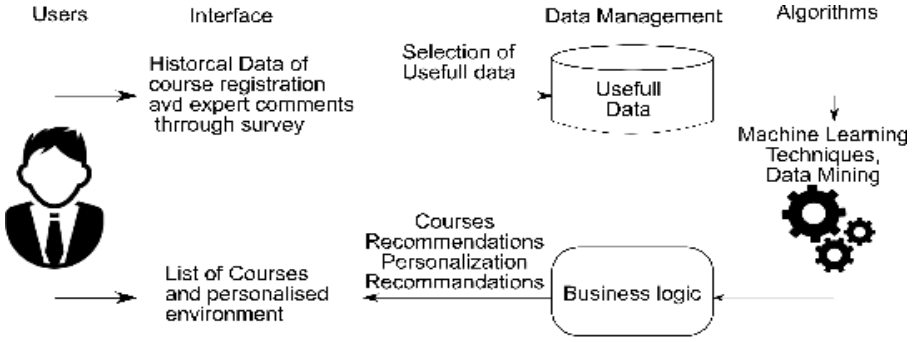
Index Terms - Collaborative Filtering, Decision Tree (DT), K-Nearest Neighbor (KNN), Linear Regression

I. INTRODUCTION

It is important for students to pick the correct path during their formative years since their future relies on it. The pupil might not be capable of being responsible for choosing wisely. The incorrect course choice leads to a significant mismatch across the student's talent, competence, and personal interests. The structure of the educational system is becoming more complicated as a result of the growth in the number of students and the variety of online courses that colleges now offer. Students have a difficult time successfully finding the courses they want due to the current situation.[4] The primary goal of recommendation systems for students is to empower them with the information they need to choose the course that will best advance their job. The user model, the counselor model, and the suggestion algorithm program all come together to make up a recommendation system. To help students choose their courses more wisely, course recommendations aim to make the most of the knowledge and recommendations that are made available. As a result, recommendation systems are becoming more important as a result of changes to the educational system that make it more difficult for students to choose the route they want to take. In recent years, recommendation systems have gained significant popularity and are widely used in various applications, including daily web browsing. Examples of these systems can be found on popular platforms like Amazon, YouTube, and Netflix, where users receive suggestions for additional items or videos based on their previous searches. Sometimes, these recommendations are surprisingly accurate and align with the user's preferences. Additionally, Google Scholar offers a recommendation system that helps users find relevant research articles by creating a public scholar profile that analyzes the user's research interests and scans the internet for new and relevant articles.

In summary, recommendation systems are being utilized in numerous applications to enhance user experience and provide personalized suggestions and recommendations. [12]

As online courses become more popular, it becomes overwhelming for students to decide which courses to take. Choosing the wrong courses can lead to students dropping out. The number of students who graduate every semester from schools and universities is ever-increasing, and every semester they take a variety of courses but do not have a clear idea as to whether these courses will be useful for their desired careers. Students also have trouble deciding which courses will be best for their specific career goals. For instance, if a student wants to work as full-stack web developer in the future, they should be aware of the current market demands



for that position. To be a viable candidate for that job, they should acquire those skills.

Fig 1: Course suggestion System

It can be difficult and time-consuming to find the right classes and opt for which ones to enroll in. Finding the proper locations to look for course offerings, the content of each course, its length, prerequisites, instructors, workload, etc. are just a few of the different considerations that may come into play when choosing a course.[5] Because each person has a unique background, education, and desired job goal, using the expertise and suggestions of other users to choose a course could be misleading. One student's benefit from a lesson. An example of course suggestion system is presented in Fig. 1.

II. LITERATURE REVIEW

In recent years, course recommendation systems have been gaining significant attention since they allow learners to navigate a wide range of educational resources that are available to them. They also help learners to select courses relevant to their requirements and interests. The literature on recommendation systems can be categorized as recommendation algorithms, user modeling techniques, and evaluation metrics. Recommendation algorithms are the core of any recommendation system. The most widely used suggestion algorithms include collaborative filtering, content-based filtering, and hybrid filtering methods. In recommendation systems, collaborative filtering is widely used because it can be used to find similarities in people's behavior or preferences. This is so that the recommendation system can be more effective.[7] The content-driven filtering recommends courses based on course content, such as title, description, and keywords. Hybrid approaches combine collaborative and content- driven filters for more accurate recommendations.[6] User modeling techniques are used to represent user preferences and interests in course recommendation systems. User modeling can be done explicitly or implicitly. Explicit user modeling involves asking users to provide their preferences through surveys or questionnaires. Implicit user modeling, on the other hand, uses data generated from user interactions with the system, such as clickstream data, to infer user preferences. Evaluation metrics are used to measure the effectiveness of course recommendation systems. Precision, recall, and F1 score are among the most commonly used metrics for evaluating course recommendation systems. One of the most popular metrics for assessing course recommendation algorithms is the F1 score, followed by the precision, recall, and F1 score. Recall quantifies the proportion of recommended courses that are relevant, while precision quantifies the proportion of recommended courses that are pertinent [11], The F1 score is calculated as the harmonic mean of the recall and precision scores Itmazi et al. discuss the importance of recommendation systems. This paper focuses primarily on the use of learning management systems together with recommendation systems as part of the instructional process. The article describes a range of approaches that can be used to design a learning management system that fits the needs of learners. There are several distinct strategies, including content-based systems, collaborative filtering systems, rule-based filtering, and hybrid recommender systems. This study analyzes the capability of learning management system

recommendation systems and develops an innovative algorithm for a recommendation system to suggest a list of suitable courses to students as they register for courses. The algorithm of the recommendation system is designed to recommend a list of courses to students based on their interests and career goals. The algorithm also takes into consideration the students' past course selections and their performance in those courses. A hybrid approach using collaborative filtering, content-based, rule-based filtering, and a demographic-based system was proposed by the author. [1] Imran et al. implemented a learning system that is one of the technologies to be used in a personalized recommendation system. The effectiveness of the system's suggestion is impacted by the fact that conventional algorithms place more emphasis on user ratings than on shifts in user interest or the veracity of rating data. To address this issue, a new algorithm is presented in this article. This idea is founded on the assumption that users with comparable interests have similar preferences. Finding neighbors with comparable interests to the current user will be made easier with the aid of a similarity calculation based on user ratings. In this case, the scores of the neighbors for the same object can be combined to predict the active user's preference. Finally, top-N classes are offered that the active user is most likely to take advantage of. But collaborative filtering algorithms only consider similarity scores instead of user interests when measuring similarities. [2] Badarenah et al. implemented a collaborative recommendation system that identifies university elective courses based on courses that other similar students have taken. An association rule mining algorithm is employed as the underlying technology in the proposed system to identify patterns between courses. A performance evaluation of the proposed approach was conducted using real datasets. The recommendation system suggests courses and predicts the expected score for these courses. Usually, students have the option to choose from a variety of elective courses, but they often seek guidance from other students who have taken these courses. To facilitate this, the recommendation system identifies same students and then applies an association rule mining algorithm to determine course associations based on their selected courses. [3] Tanay Kulkarni et al. The proposed system aims to monitor the learning process of students based on available resources, in order to identify their areas of interest and provide applicable recommendations. With the vast amount of information accessible on the web, it is determining to bring out only the most applicable information that fulfills the user's searching criteria. To address this concern, the model first develops to enhance search accuracy and efficiency, a web crawler that prioritizes keywords is utilized to extract URLs that contain the user's searched keywords. These relevant web pages are then selected for further processing. The system will analyze on ensuring precise recommendations by implementing effective user profiling and content fetching techniques. Specifically, it covers the URLs pertaining to user activity and how they can aid in recommending content to other users. [13]

III. METHODS

This project is a machine learning-driven course recommendation system that makes use of the decision tree principles to offer a practical way to make choices and generate all possible results. With the help of the suggested method, users can create lifelong learning pathways that meet their specific professional needs. NLP techniques are used in the recommendation system to automatically process employment offers and extract the necessary knowledge and skill sets. Users can identify the skills and abilities they need to grow, and courses can be taken to help them do so and expand their job opportunities. [8] The proposed hybrid recommendation method system suggests courses to students for their prospective careers using a taxonomy-based methodology. The system provided a student profile taxonomy, a taxonomy for courses, and a taxonomy for employment offers. According to tests, using taxonomies can enhance suggestion outcomes, lessen information overload, and resolve issues. The authors proposed that useful knowledge could be enhanced by adding context to make the system more thorough and intelligent. [10]

Collaborative Filtering : The technique of collaborative filtering is at the core of recommendation systems, as it allows for the prediction of a user's interests based on the preferences and information gathered from multiple users. In essence, collaborative filtering is a process of analyzing data to make automated predictions about a user's interests.

K-Nearest Neighbor : The K-Nearest Neighbor (KNN) is a method in machine learning that predicts the class of a data point by analyzing the labels of its neighboring data points. It works by storing all available data points and classifying new data based on the similarity measures with the stored ones. The algorithm is commonly used for classifying data points based on how their neighboring points are classified.

Decision Tree : In machine learning, the decision tree is a guided learning method. A tree-structured classifier known as a decision tree uses internal nodes to symbolize a data set's features, branches to represent the decision rules, and leaf nodes represents the results of the decision. The decision tree provides a visual representation of all potential solutions to an issue based on a specific decision condition.

Linear Regression : Linear regression is a supervised machine learning technique used to predict a continuous target variable based on one or more input features. It assumes that there is a linear relationship between the input features and the target variable and uses the least squares method to determine the best-fitting line through the data points. Essentially, linear regression seeks to find the straight line that best represents the relationship between the input variables and the output variable.

IV. PROPOSED APPROACH

Collecting Data from Excel file - The input for a learning platform consists of a spreadsheet that contains information about the reviews and likes that users have submitted. This spreadsheet serves as a source of data for the platform to process and analyze. It is necessary to extract the data of reviews and the number of enrolled individuals from this sheet. A set of coordinates for the starting point of each test are generated and returned to a function get Coordinates. It is then necessary to iterate through the sheet, extracting the reviews and enrolling counts from each set, and putting these into a file called Enrolled Count, which correlates the number of participants with the cognitive domain of each search falling under that domain.

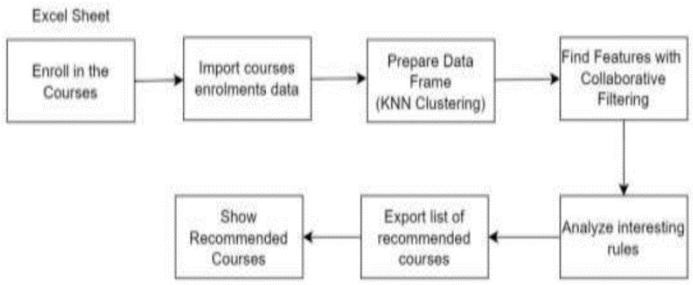


Fig.2 Flowchart of the proposed approach

Classifying Courses Based on Reviews and Enrolled Count –

Now use the KNN approach by considering the attributes that include what kind of courses are learned by the enrolled student, ratings given by the user, and how many hours the user spends, etc., and store this data as a historical activity set of the user. Fetch all available courses in the database and categorize these courses into groups by viewing the nature of the study. Import the student datasets and course datasets to prepare the data frames that have the common factor as the study stream and include what types of courses were learned by the user in the course dataset.[9]

Clustering the Course to identify domain -

Open a CSV file using the KNN Clustering function which contains:

- Course rating – The ratings of every individual course for every particular domain.
- Views – Views of the Course.
- What course the student is looking?

Generating Courses list -

Generating Course-Specific Links Use the collaborative filtering technique for the model to filter the data. A list of courses is generated as the outcome. Extract the list and analyze the data in the list that matches the user's interest or not. Repeat the training with various datasets which helps the model to generate accurate test results. Now the system recommends the highly preferred course from the list is recommended to the learners.[9]

Recommendation to new Users –

The system will classify a new student as belonging to a particular group based on the pre-defined pattern of identification, and a set of courses that are most likely to appeal to the student will be recommended based on this frequent pattern of identification when a new student enters.

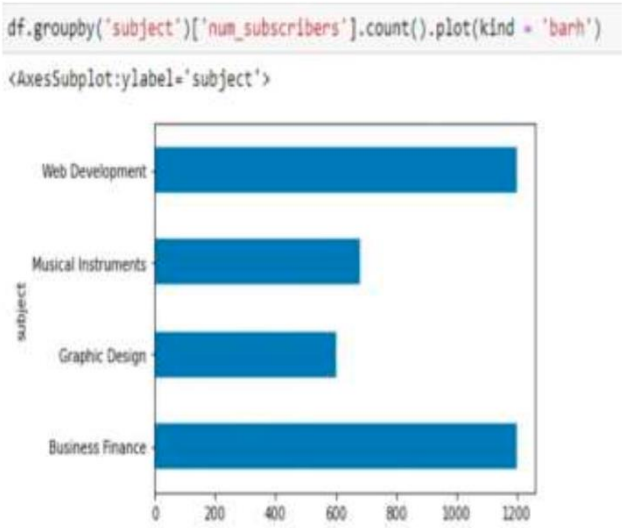


Fig 3.

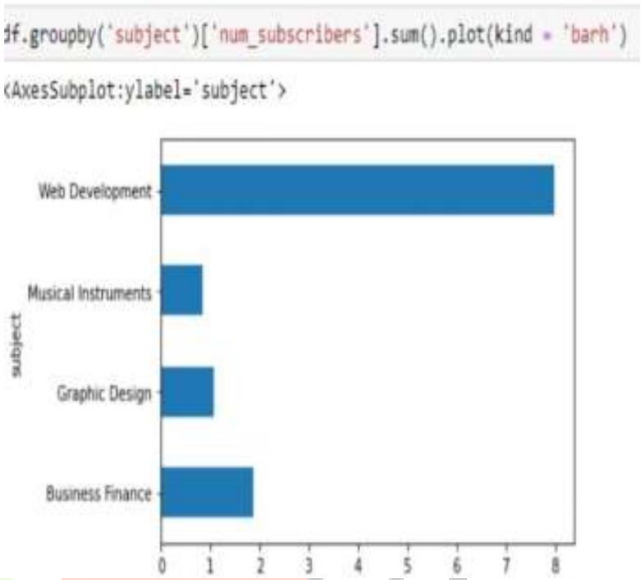


Fig 4.

The collaborative filtering initially classifies the courses by viewing the course's subject domain and generating separate datasets which vary with every individual dataset. From the main dataset, the features like the count of users who are enrolled in each course are considered and every course comes under a particular domain, this particular domain is considered as input to generate a graphical representation that shows the total count of enrolled users of domain irrespective of every individual course. In the web development domain, various types of courses are included. The courses like HTML, CSS, JavaScript, ReactJS, nodeJS, MySQL, WordPress, AWS, Ajax, jQuery, AngularJS, Django, mongo DB, Bootstrap, etc. courses are categorized as web development courses. And also various courses like Trading, Stock Market, Banking, Cryptocurrencies Inverting, Risk Analysis, Capital Investment, CFA, Marketing Qualified Lead, Auditing Practice Finance, Forex trading, etc. courses are categorized as Business and Finance domain courses. In a

similar way, the main Excel data set includes four domain categories like Business and Finance, Music instruments, Graphics Designing, and Web development.

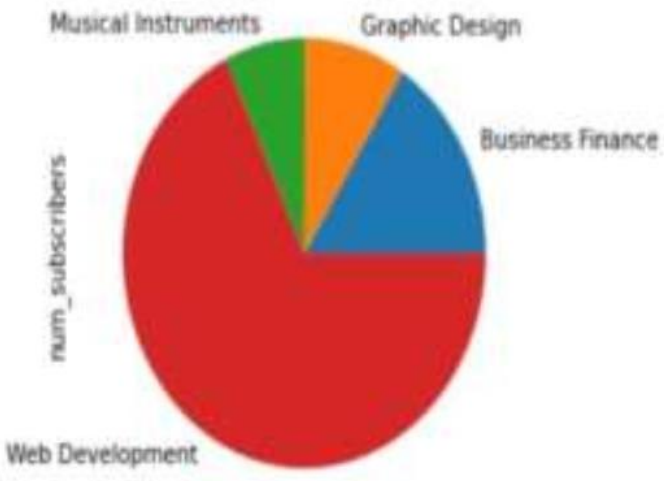


Fig 5.

Figure 5 represents a pie chart. The pie chart varies every subject domain by considering the number of subscribers enrolled in various courses for every individual subject domain. In the pie chart, the web development domain is indicated in red, the businesses and analysis domain in blue, graphics design in orange, and musical instruments in green. Even though the available excel file contains an equal number of web development and business analytics courses, irrespective of the count of every course of every domain, the pie chart considers the total number of subscribers of every subject domain. In every individual domain, the courses with a similar name are categorized as a group that has the same property and the same kind of information available in it. In the web development domain, consider a course like JavaScript. In the main Excel dataset, nearly 50-100 courses include JavaScript teachings. Identifying the best course is quite hard among all the courses. So our system uses a collaborative filtering technique to handle the problem that involves choosing an appropriate course. The features to be filtered from the courses are the number of likes, number of reviews, and number of students enrolled in the course. Every JavaScript course filtering involves calculating the views count, likes count, number of reviews given by the learners, and finally how many learners are enrolled in that particular course. By calculating all these features, the courses are listed in descending order in which the course with the highest average among all the other courses is suggested first, and then the remaining courses with low average points are recommended gradually to the user. The process is same for other domains, like considering a course named Trading, Every trading course filtering involves calculating the views count, likes count, number of reviews given by the learners, and finally how many learners are enrolled in that particular course. By calculating all these features, the courses are ordered in descending order where the course with the highest average among all the other courses is suggested first, and then the remaining courses with low average points are recommended gradually to the user. Every subject domain and all courses in their respective domain undergoes the collaborative filtering process to generate the groups which include the same kind of courses which group by viewing the name of the particular course. After calculating all features like the number of reviews, likes, and enrollments the system generates the highly scored courses as outcomes which further recommended to the users

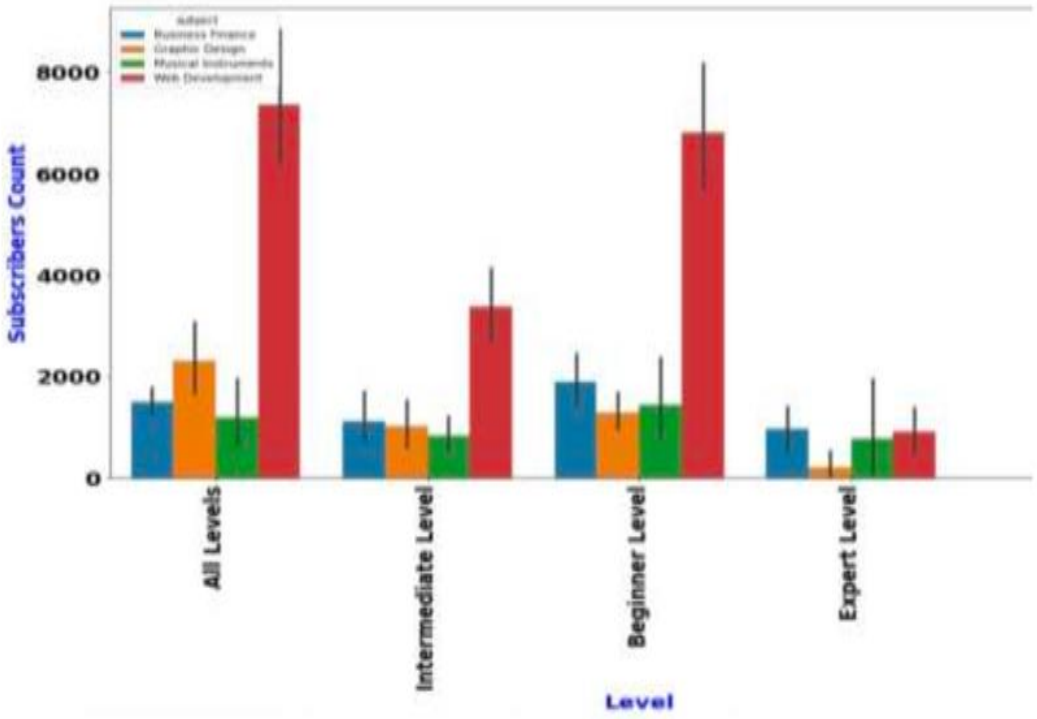


Fig 6.

Figure 6 shows a graph in which the X-axis represents the difficulty level of the courses for every individual domain, and Y-axis represents the number of subscribers associated with the subject domain difficulty level. The input is an excel sheet contains features like the likes, reviews, and number of enrollments of every user in the learning platform. The data of reviews and enrolled count needs to be extracted from this sheet. And also additionally to calculate the course difficulty the extra feature like the level of the course is extracted from the Excel file. In finding the difficulty level of every course, the domain is taken as the key to identifying every level of the course. For example, the web development domain consists of a huge number of courses, the file consists of multiple courses for a single titled course, and each course has its difficulty like Beginners, Intermediate, Expert, and all levels, etc. So every course with a beginner's level is categorized as a single dataset, every course with an intermediate level is categorized as other individual datasets and for experts and all levels are generated separately for the web development domain. Similarly, remaining domains have its courses level categories.

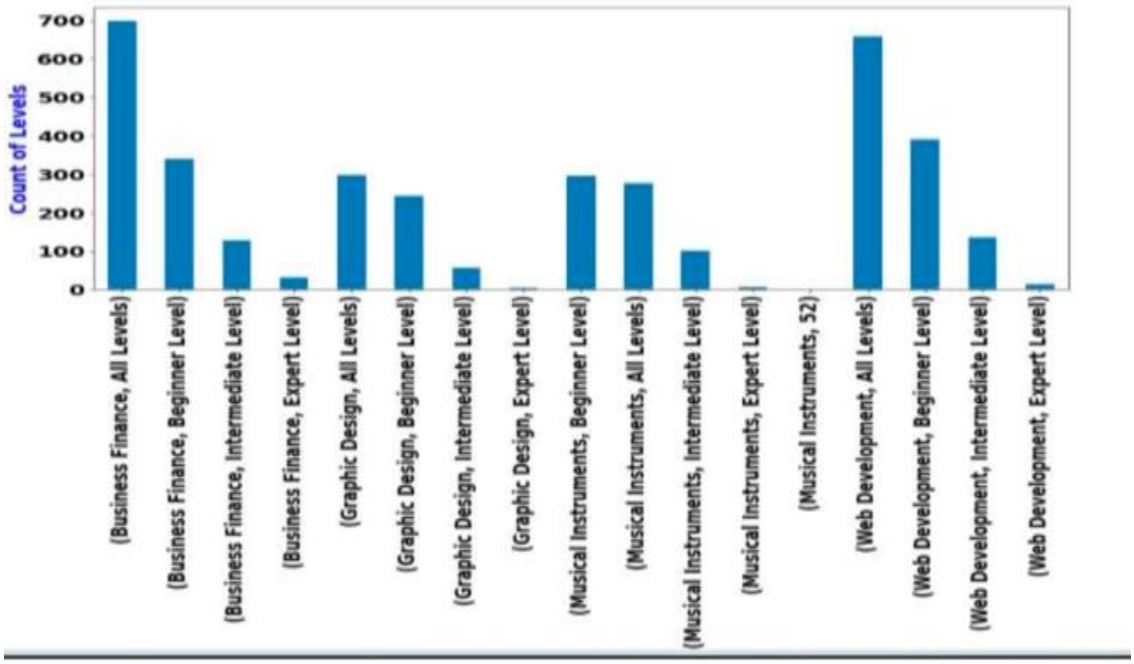


Fig 7.

Figure 7 elaborates the figure 5. Figure 6 shows a graph in which the X-axis represents the separate difficulty levels of the courses for every individual domain, and Y-axis represents the number of subscribers associated with the subject domain difficulty level. Every difficulty level (Beginner's, Intermediate, Expert, and All Levels) are separately indicated by associating the subscribers count on Y-axis. Every individual course's level has its graph representation which has its subscribers count for the respective subject domain.

V.RESULTS

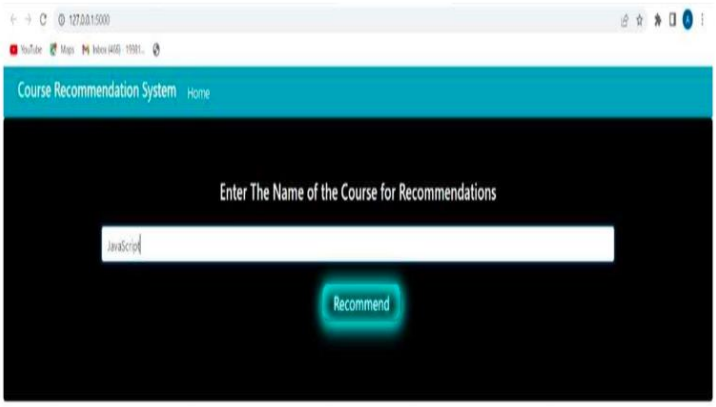


Fig 8.

Figure 8 shows the web interface of the proposed system. The proposed system web interface is a user-friendly interface, it consists of an input search field and a recommend button. The user enters a course name in the search field and clicks the recommend button then the system analyzes the input title with all the titles in the dataset. Match the input title with all available titles and list the matched titles in a separate dataset. Now among all the courses in the list, the courses with the highest recommendation score in descending order are suggested to the user.

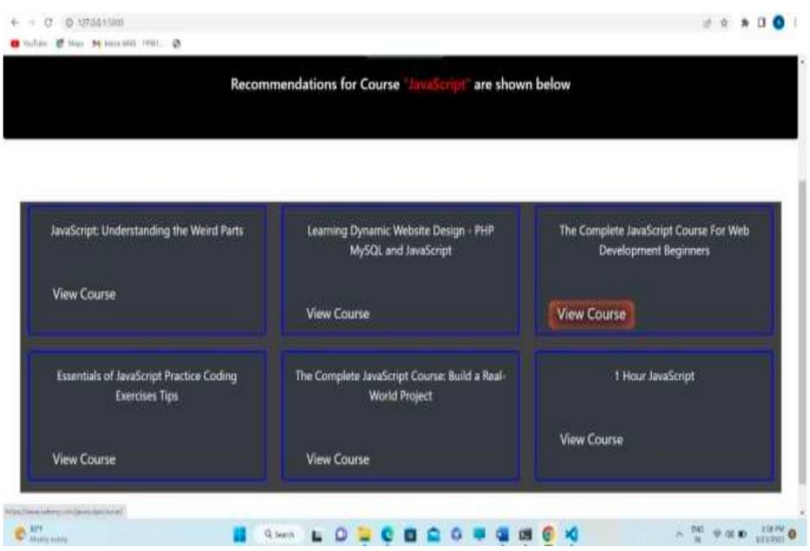


Fig 9.

Figure 9 is an example. JavaScript course is recommended to the user. In the Excel file, nearly 50-100 courses include JavaScript teachings. So the system uses a collaborative filtering technique to handle the problem of recommending an appropriate course. The features like the number of likes, number of reviews, and number of students enrolled in the course are to be filtered. The filtering involves calculating the views count, likes count, number of reviews given by the learners, and finally how many learners are enrolled in that particular course. By calculating all these features, the courses are listed in descending order in which the course with the highest average score among all the other courses is suggested first, and then the remaining courses with the low average score in descending order are recommended gradually to the user. Similarly for recommending a course titled MySQL, the process is repeated.

VI. DISCUSSION

One of the main benefits of a course recommendation system is that it can assist users to save time and effort when searching for courses that are specific to their needs which can lead to a saving in time and effort. Instead of manually searching through lists of courses, users can receive tailored recommendations based on their interests and preferences. In online learning environments, where a large amount of content is available and it can be overwhelming for students to choose from course recommendation systems are especially valuable. With targeted recommendations, these systems can assist users in staying engaged and motivated, enabling them to progress toward their learning goals. This project provides an application with an user friendly graphical user interface (GUI). Where the system will make suggestions after the user enters the course name. The suggested system focuses on using a collaborative filtering technique with knowledge-based recommendations to point students in the direction of the most suitable course. The suggested system will use the KNN algorithm to map all similar students based on the data set that is currently available. The knowledge-based trained model suggests appropriate courses for students after the collaborator filtering method. Additionally, the system's design uses few resources.

VII. CONCLUSION

In conclusion, the use of course recommendation systems has become an essential tool in ensuring that students receive a personalized and relevant learning experience. The effectiveness of the system depends on its ability to accurately recommend courses that align with the student's interests and needs. The proposed hybrid course recommendation system combines collaborative filtering and content-based filtering to improve course recommendation quality. Using similar users' behavior and preferences, the system can make more accurate recommendations based on the content of the course. As a result, student engagement, satisfaction, and retention can increase. Personalization of learning experience is becoming increasingly popular, and developing and implementing effective course recommendation systems will become increasingly important in the future of education.

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